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Superconducting Connections to Films

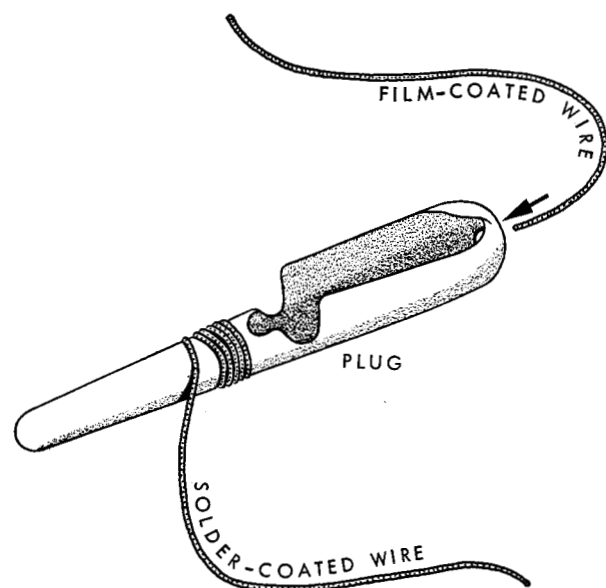


Figure 1 Modified AMP taper plug for compressing lead powder.

A method for making superconducting connections to thin films of evaporated metal deposited on wires has been found useful at this laboratory. Compressed lead powder of the smallest commercial particle size is used as an intermediate contact between the film and external circuitry.

Two methods have been used to make connection to a cylindrical film. The first uses a specially prepared plug.* The prongs are flattened down, a solder-covered wire is soldered to the tapered end, and the whole is covered with a surface coating of solder, as shown in Fig. 1. The film-coated wire is inserted into the hole at the end of the plug. The cavity is then filled with the finest lead powder and a crimper is used to compact the lead. The correct amount of lead is not critical and can be determined by eye after a few trials.

In the first method, the film coating is easily damaged by flexing the unsupported wire. A second method, which is easier to apply than the first, reduces the strain by supporting the wire on a plastic base which remains permanently attached to the sample, as shown in Fig. 2.

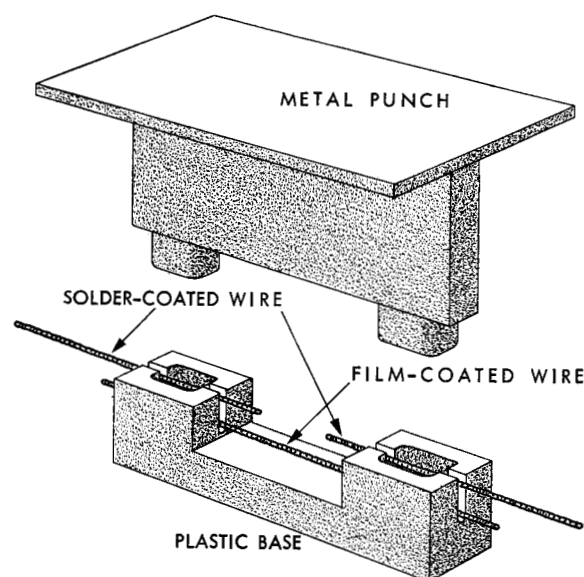


Figure 2 Plastic base and metal punch for compressing lead powder.

A small amount of powdered lead is put into the cavities at the ends of the plastic block, and the wire bearing the film is inserted in the slots. Solder-coated copper wires are also put into each cavity through the same slots, and the cavities are then filled with powdered lead. The punch is used to compact the lead under a pressure of about 5000 psi.

The current at which the self-field transition out of the superconducting state takes place is determined by passing successively greater known currents through test specimens comprising a short length of film-coated wire and two connections. The first appearance of voltage across the specimen, as detected by a voltmeter with 10-microvolt full-scale sensitivity, serves to identify the onset of the transition.

Contacts made to evaporated tin films by the first method have carried up to 200 ma at a temperature of 3.67°K without switching. Contacts made by the second method to similar tin films have remained superconducting while carrying currents up to 1.25 amp at 3.67°K.

*Manufactured by Aircraft Marine Products, Inc.

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